ZAT 20
Coaxial
Token-Ring

User's Manual

ERICSSON

WEEKRAPPORT

Weeknummer;_____.
Naam monteur;_____hoofd/hulp*

Datum							
Projekt							
Bestuurder	ja/nee*	ja/nee*	ja/nee*	ja/nee*	ja/nee*	ja/nee*	ja/nee*
Vervang. auto Evt kent	ja/nee*	ja/nee*	ja/nee*	ja/nee*	ja/nee*	ja/nee*	ja/nee*
Vertrek tijd	DC/H/KL*	DC/H/KL*	DC/H/KL*	DC/H/KL*	DC/H/KL*	DC/H/KL*	DC/H/KL*
KM stand							
Aankomst							
KM stand							
Reistijd							
Afstand							
Eindtijd							
Aankomst tijd	DC/H/KL*	DC/H/KL*	DC/H/KL*	DC/H/KL*	DC/H/KL*	DC/H/KL*	DC/H/KL*
KM stand							
Reistijd							
Afstand							
Totale; reistijd							
Afstand							
Werkuren							
Overuren + pauze							

Paraaf monteur; Paraaf projektleider; Ingevoerd;

Projektnummer snipperdag = 1
Projektnummer verlofdag = 2
Projektnummer ziek = 3
Projektnummer dokter/tandarts = 4

*Doorhalen wat niet van toepassing is!

ZAT 20
Coaxial Token-Ring

User's Manual

ERICSSON

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Preface

This manual presents a brief description of the ZAT 20 Coaxial Token-Ring system. It also gives comprehensive operating, installation and maintenance instructions for the ZAT 20 equipment.

Please contact your Ericsson representative for the latest information.

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ZAT 20 Coaxial Token-Ring User's Manual

Contents

Introduction

Welcome

This installation guide describes how to operate, install and maintain the ZAT 20 equipment.

The ZAT 20 is a transparent transport system for Token-Ring on the physical layer in the OSI-model. The ZAT 20 is designed for data communication in environments with stringent requirements for operational reliability. The network can handle all types of stations equipped with an electrical interface that complies with the IEEE 802.5 standard of 4 and 16 Mbit/s Token-Ring. With this system, stations may be interconnected in a Token-Ring network with either 93 ohm or 75 ohm coaxial cable.

The *Design* chapter describes the different products in the ZAT 20 family, how they are designed and a specification of the connectors and indicator LEDs.

How the ZAT 20 works during normal operation and during looped operation is described in the *Function* chapter. The looped operation could for example be caused by a break in one cable segment.

Considerations when planning and installing a Token-Ring network are discussed in the *Configuration* and *Installation* chapters.

Guidelines for troubleshooting a Token-Ring network, modifying and extending an existing ZAT 20 installation and a summary of different application examples are added at the end of the manual.

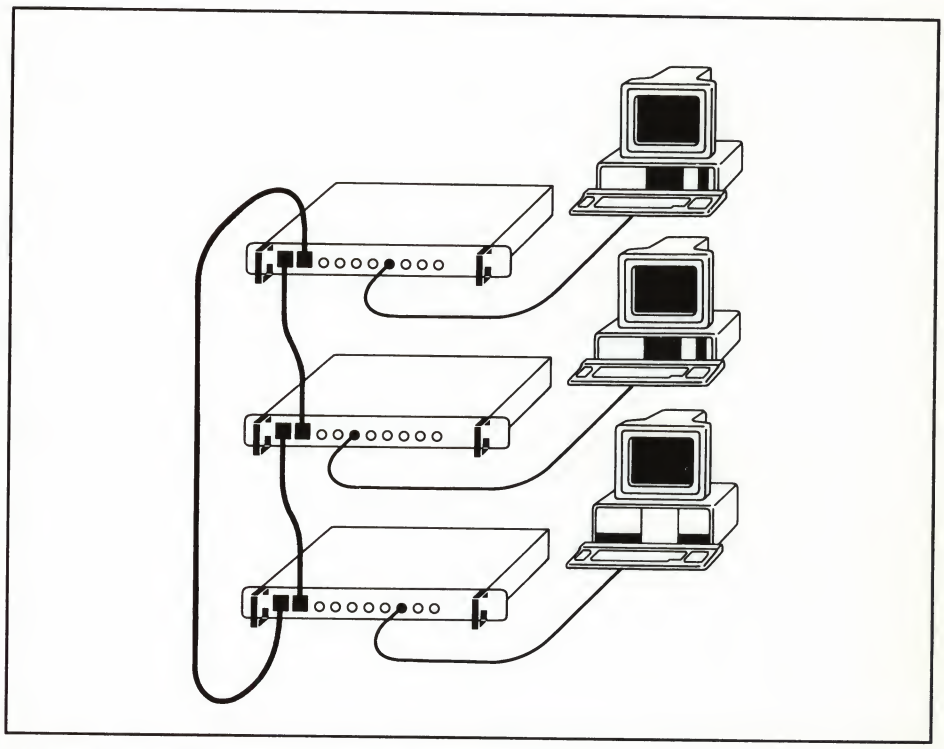

Figure 1. ZAT 20 system diagram, example.

Technical data

Electrical data interface	According to IEEE 802.5
Network topology	Redundant coaxial cables or Type 1 cables in the trunk ring, with or without automatic reconfiguration. Stations are connected to the CMAU in a star configuration with coaxial cables.
Stations per CMAU	Maximum 8
Station count	2 (Meaning: 128 stations may be interconnected in an all coaxial Token-Ring network.)
Transmission distance between CMAUs	Up to 500 m, 4 Mbit/s Up to 200 m, 16 Mbit/s
Transmission distance between CMAU and station	Up to 500 m, 4 Mbit/s Up to 200 m, 16 Mbit/s
Electrical interfaces	
Coaxial CMAU	12 BNC connectors and one IEC power entry connector.
Type 1 CMAU	8 BNC connectors, 2 Type 1 connectors and one IEC power entry connector.
CTC	One DB9 and one BNC connector.
Power requirements	
Voltage	230V (198-254V)
Power consumption of CMAU	Maximum 12 W
Environment	
Temperature	0 to +45°C
Humidity	Max 95% (non-condensing)

Mechanical data

CMAUs	
Height x width x depth	45 x 480 x 175 mm
Weight	2.9 kg
CTCs	
Height x width x depth	20 x 37 x 55 mm
Weight	40 g

Values of transmission ranges apply throughout the entire temperature range and a projected lifetime of 10 years. Distance values apply to standard cables and installations with standard connectors.

Token-Ring configuration

A Token-Ring network is made up of a number of stations logically interconnected to form a ring. This ring carries a signal with a unique bit pattern: a so-called 'token'. A station transmitting a message via the ring modifies the circulating token by changing the bit pattern. Thereafter, the station can transmit its message, preceded by the addresses of the receiving and transmitting station. Now, since no free token is available, no other station can transmit a message. When the addressed station is reached by the message, the station will recognize its own address and make a copy of the message. Once the transmitting station has reached the end of its own message in return and found it successfully transmitted, it will erase the message and transmit a new free token on the ring.

A time-limiting function prevents any station from utilizing the ring for too long a time. Otherwise, all stations would not have the same opportunity to communicate through the ring. However, a priority scheme exists in order to prevent bridges, servers and other resource stations with a high traffic load to become bottlenecks in the network.

Base software is installed in the workstations as well as in the servers. The workstation is the Personal Computer (PC, PS/2 etc.), giving the user access to the network. The server can be used for sharing software, peripherals, communication etc.

Workstation software enables the user to employ the server's facilities. These are controlled by the server software. By using various kinds of software, the server can be employed in a number of different configurations. For example, it can offer the option of sharing applications, files, and hardware connected to the network.

Other functions that may be included in the network are, for example:

- Router; a networking function which uses network protocols to control network communication between stations and which forwards messages to end-stations or other routers.

- Bridge; a data link function which is used to connect similar or dissimilar LANs.

- Gateway; a server function which connects dissimilar networks.

Within a network, the same unit can function as a server and, for example, a gateway or a bridge.

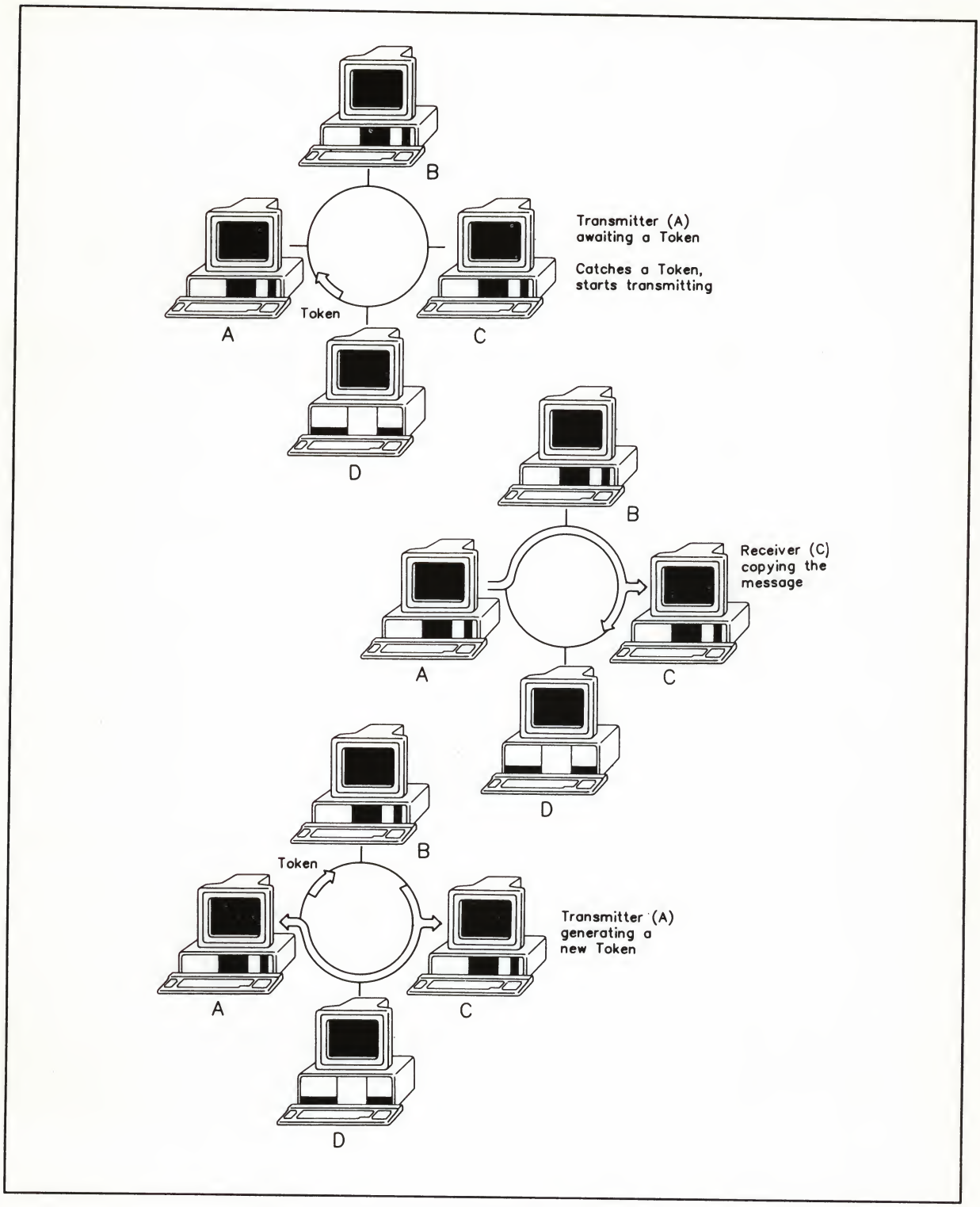

Figure 2. Token-Ring block diagram.

Design

ZAT 20 system

The ZAT 20 system is made up of Coaxial Multistation Access Units (CMAUs) with either Coaxial or Type 1 Ring In/Ring Out connections and Coaxial Token-Ring Connectors (CTCs).

The CMAUs are interconnected in a ring configuration either via coaxial cabling or Type 1 cabling. Up to eight stations can be connected to each CMAU in a star configuration by means of coaxial cable.

The CTCs are directly attached to the DB9 connector on a standard electrical Token-Ring board. The CTC is equipped with a BNC connector which is connected to the lobe port of the CMAU by means of a coaxial cable.

All models and versions of CMAUs and CTCs support both 4 and 16 Mbit/s Token-Ring without strapping. However, 4 and 16 Mbit/s cannot be mixed in the same physical network.

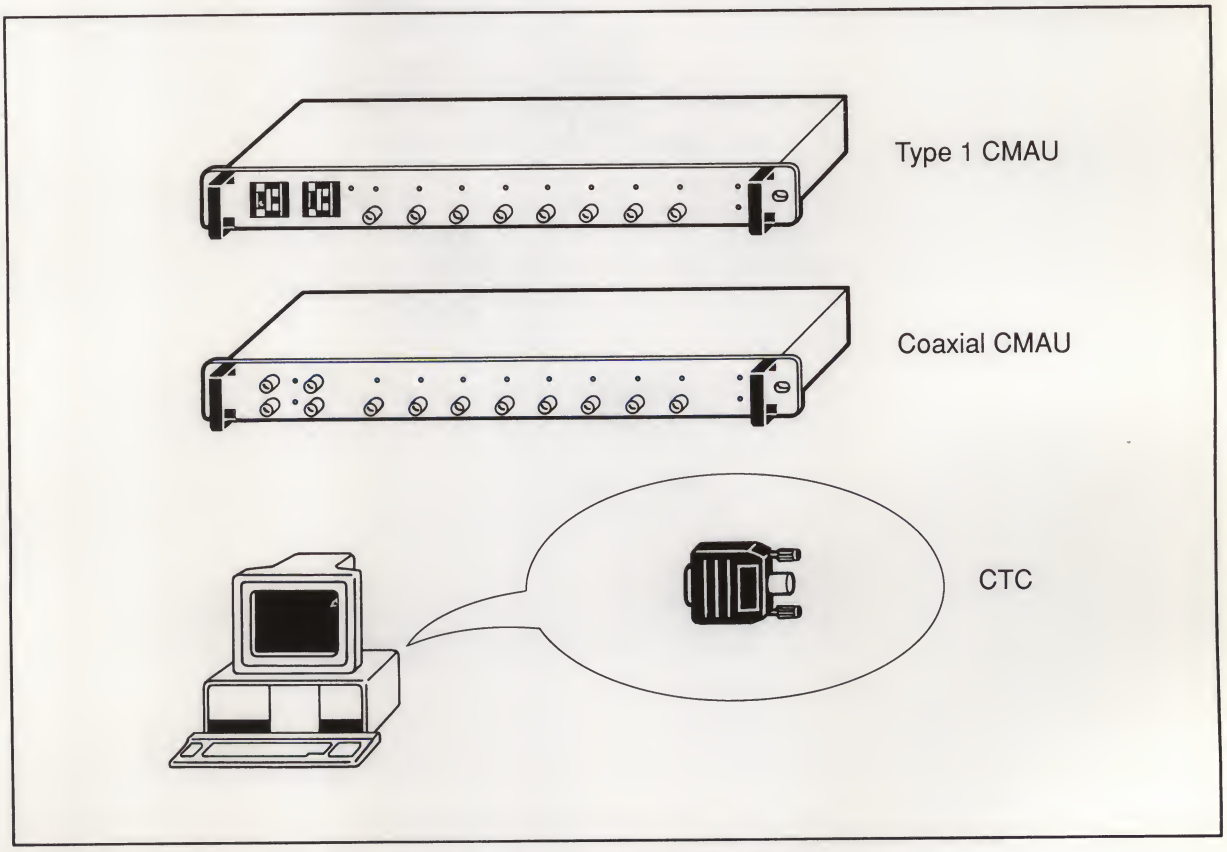

Figure 3. Main components of the ZAT 20 system.

Coaxial CMAUs

These CMAUs have two BNC connectors for Ring In (RI) and two BNC connectors for Ring Out (RO). They have one BNC connector for each of the eight lobe ports.

The Coaxial CMAUs have ten yellow indicator LEDs. When the LEDs at the lobe ports light, they indicate that a PC/station is active on the ring. When lit, the LEDs at the RI/RO indicate that their respective trunk segments are OK. They go out when they loop their respective segment.

The green LED indicates "power on".

The CMAU KDU 203 09 handles RG 62 (93 ohm) coaxial cable, while CMAU KDU 203 10 handles RG 59 (75 ohm) coaxial cable to the station.

The system is powered via a separate power cord with a standard European connector intended for grounded outlets. Line power is connected to the rear of the CMAU.

The RI/RO will, in case of cable failure in its respective trunk segment, loop back the Token-Ring data automatically. This is done without losing contact with any station. In case of line power failure for one CMAU, only the stations connected to this specific CMAU will lose access to the Token-Ring network. The trunk segments will in this case loop back in the CMAU.

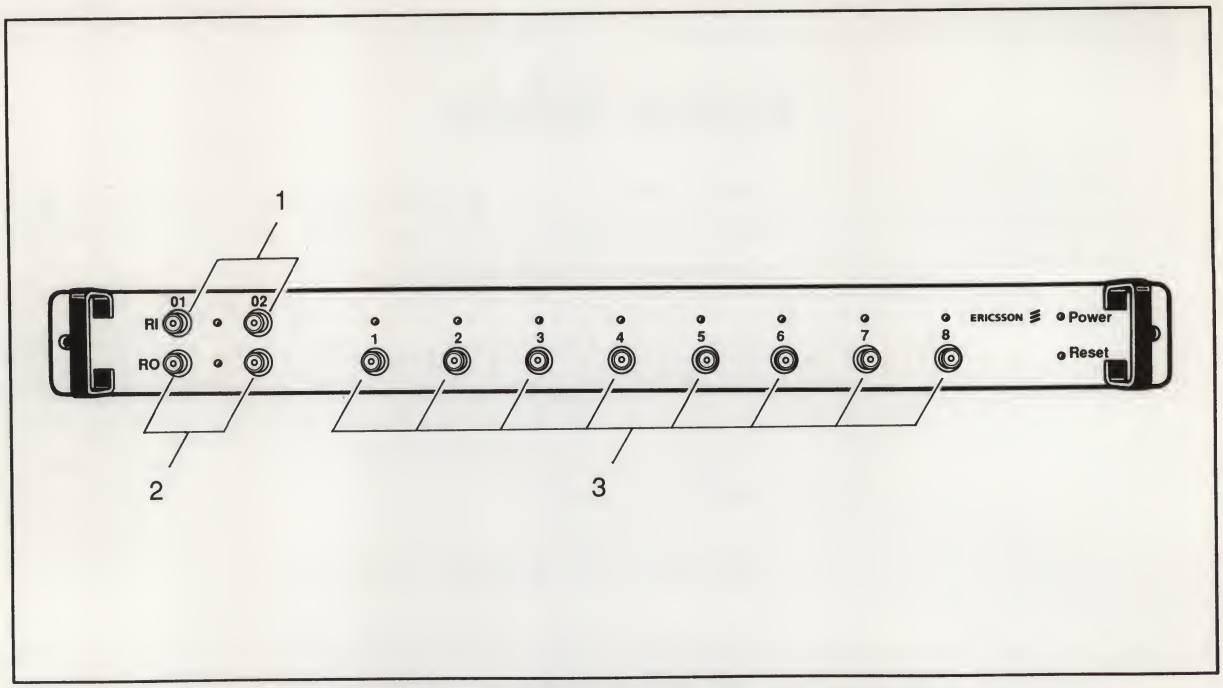

Figure 4. Connectors for KDU 203 09 and KDU 203 10.

Connection	Connector type
1. Ring In	BNC
2. Ring Out	BNC
3. Lobe ports	BNC

Type 1 CMAUs

These CMAUs are available with or without cable protection. They have one Type 1 connector for Ring In (RI) and one Type 1 connector for Ring Out (RO). They have one BNC connector for each of the eight lobe ports.

The Type 1 CMAUs have eight yellow indicator LEDs. When lit, the LEDs at the lobe ports indicate that a PC/station is connected to the ring. The Type 1 CMAUs with cable protection have LEDs at the RI/RO connectors indicating that their respective trunk segments are OK when they light. They go out when they loop their respective segment. The CMAUs without cable protection have no LEDs at the RI/RO connectors.

The green LED indicates "power on".

The CMAUs KDU 203 11 and KDU 203 12 have cable protection on the RI/RO trunk segments, while the CMAUs KDU 203 81 and KDU 203 82 have not.

The CMAUs KDU 203 11 and KDU 203 81 handles RG 62 (93 ohm) coaxial cable, while the CMAUs KDU 203 12 and KDU 203 82 handles RG 59 (75 ohm) coaxial cable to the station.

The system is powered via a separate power cord with a standard European connector intended for grounded outlets. Line power is connected to the rear of the CMAU.

The RI/RO will, in case of cable failure in its respective segment, loop back the Token-Ring data automatically if CMAUs with cable protection are installed. This is done without losing contact with any station.

In case of line power failure for one CMAU, only the stations connected to this specific CMAU will lose access to the Token-Ring network. The trunk segments pass through the CMAU, they are not looped back no matter if CMAUs with cable protection are installed or not.

The trunk segments are also passed through if no station is active on a Type 1 CMAU in order to minimize the ring length. This means that the RI/RO LEDs on the CMAU with cable protection light only if its trunk segments are OK and if at least one station is active on the CMAU.

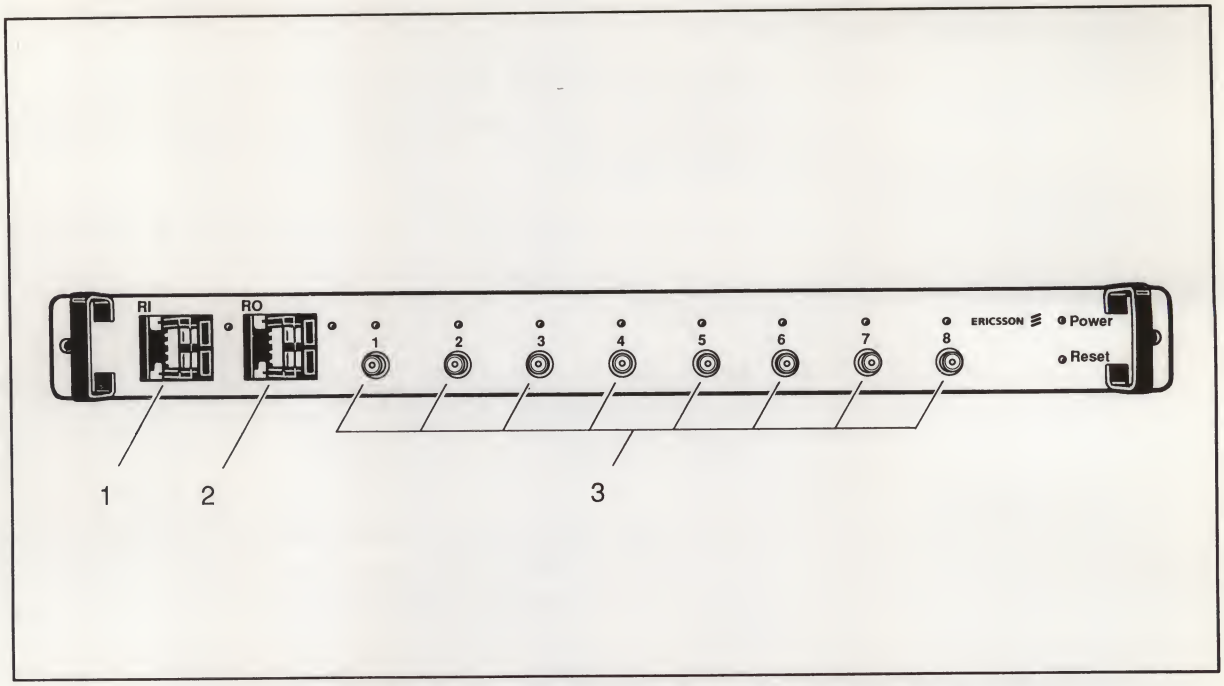

Figure 5. Connectors for KDU 203 11, KDU 203 12, KDU 203 81 and KDU 203 82.

Connection		Connector type
1.	Ring In	4 pole data connector
2.	Ring Out	4 pole data connector
3.	Lobe ports	BNC

CTCs

The Coaxial Token-Ring Connector is a small connector which can be directly attached to a standard electrical Token-Ring board. It has a DB9 connector in one end and a BNC connector in the other.

The CTC KDU 203 13 handles RG 62 (93 ohm) coaxial cable and is used together with either the Coaxial or the Type 1 CMAUs.

The CTC KDU 203 14 handles RG 59 (75 ohm) coaxial cable and is used together with either the Coaxial or the Type 1 CMAUs.

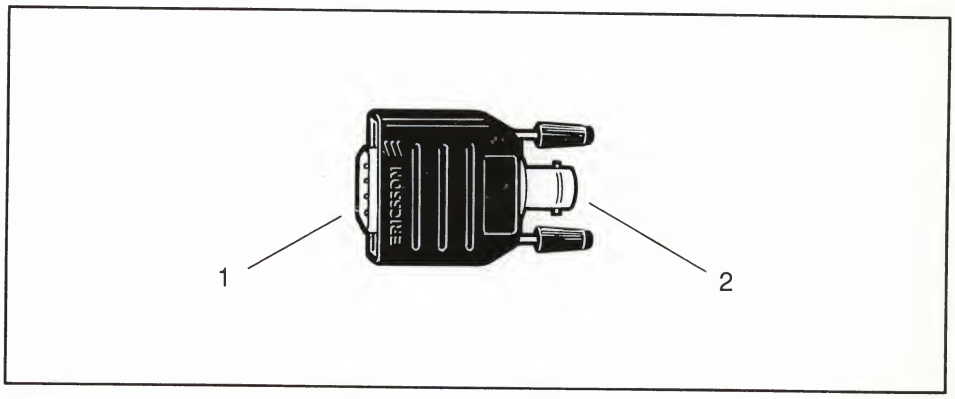

Figure 6. Connectors for KDU 203 13 and KDU 203 14.

Connection		Connector type
1.	Adapter port	DB9 connector
2.	Lobe port	BNC

Red loop-back cable

The Red loop-back cable is used when Type 1 CMAUs with cable protection and IBM type Token-Ring repeaters are mixed in the same ring. It is a straight Type 1 patch cable with two Type 1 connectors and a built-in loop-back feature.

Function

Normal operation

The green LED indicates power on.

When a station wants to make itself active on the ring, it sends out a phantom signal. This signal is transmitted by the CTC and the coaxial cable to the lobe port. The lobe port now recognizes the phantom signal and connects the lobe to the ring. The yellow LED above the lobe port lights when the station is active.

If the station is turned off, the phantom signal will disappear and the CMAU will immediately disconnect the station from the ring. This is done in order to have a complete ring. The lobe LED will go out as soon as the station is disconnected from the ring.

During normal operation, the trunk cabling that interconnects the CMAUs consists of a primary ring and a counter-rotating secondary ring. The Token-Ring data is transmitted in the primary ring and the secondary is in stand-by mode ready to feed the data back in case of a loop-back in one of the trunk segments. If both trunk segments to a CMAU are OK, the yellow LEDs by the RI/RO connectors light if the CMAU has cable protection.

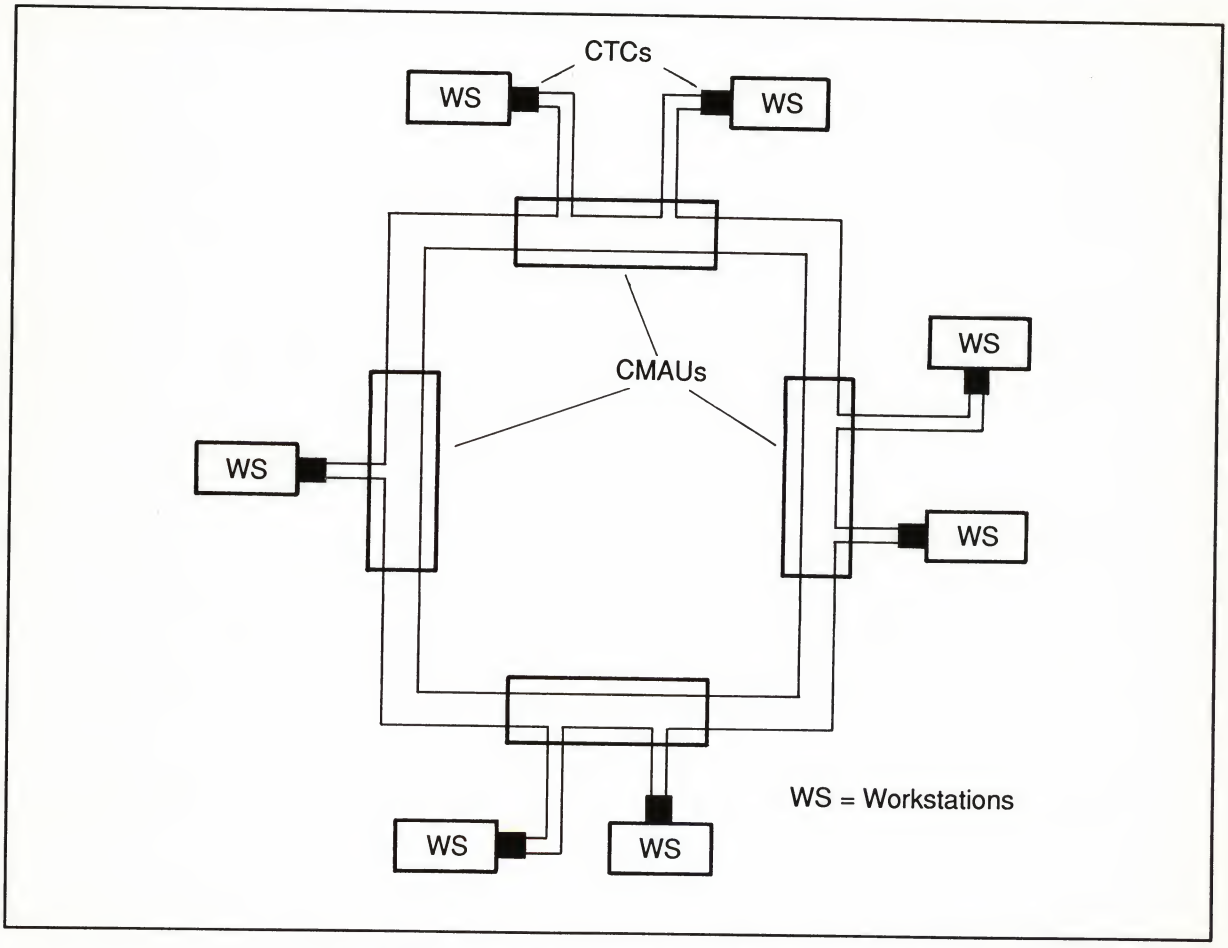

Figure 7. System block diagram during normal operation.

Looping configurations

If the coaxial cable to an already active station breaks, the phantom signal will disappear and the CMAU will again disconnect the station from the ring. The lobe LED will go out.

If a cable failure should occur between two CMAUs, completely or partly, the CMAUs at either end will immediately loop back the Token-Ring data into the secondary ring if they have cable protection. Not a single station will lose its contact with the ring as long as it is a single segment failure. The LEDs by the looped RI/RO-connectors go out.

If the mains power should fail to one CMAU, only the stations connected to this CMAU will lose its contact to the network. No LEDs light.

When the faulty cable segment is repaired or the mains power is back, the ZAT 20 automatically starts up the segments and the data is again transmitted in the primary ring.

If CMAUs without cable protection are installed, the faulty cable segment has to be manually removed before the network can go into operation again.

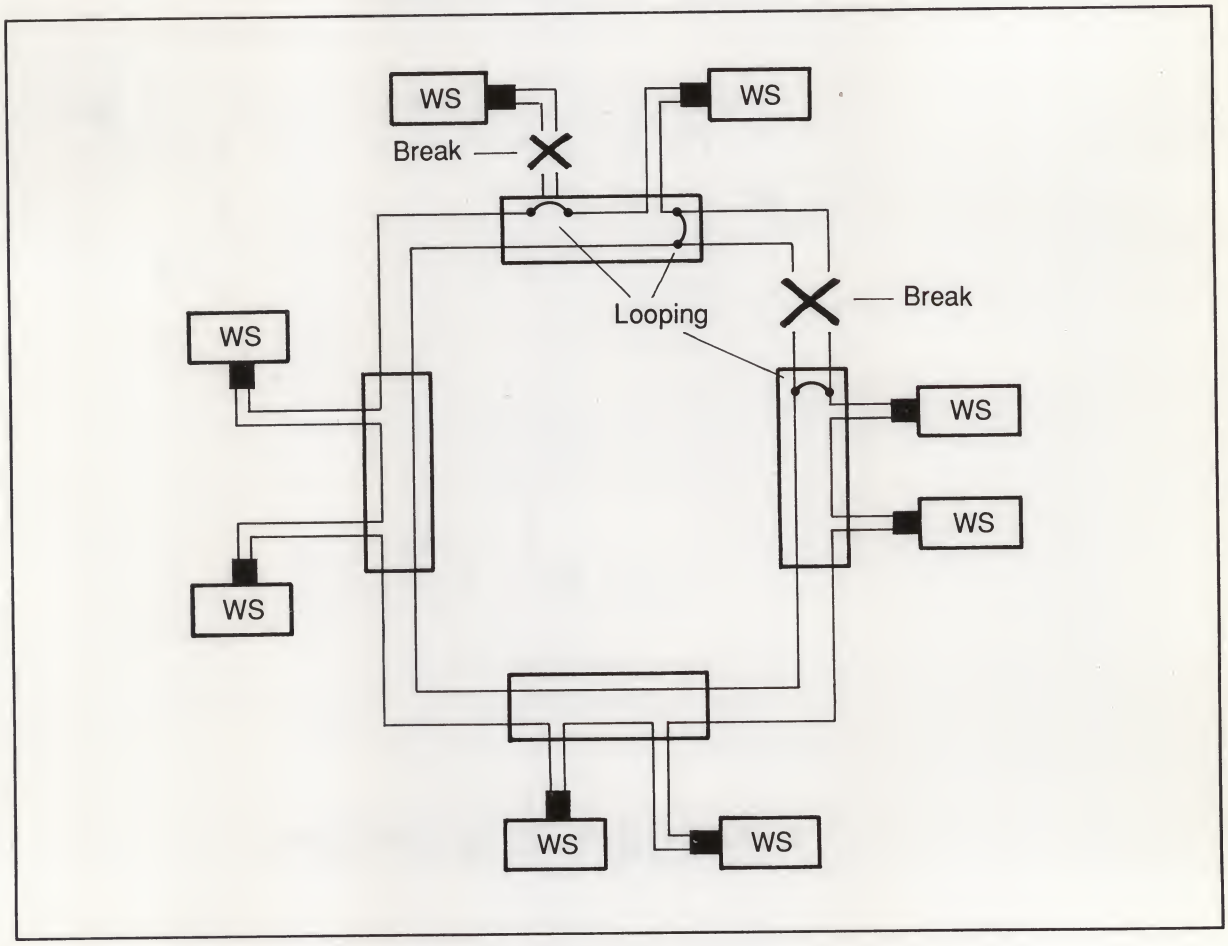

Figure 8. Looping configuration.

Configuration

CMAU configuration rules

The configuration rules for the Coaxial and Type 1 CMAUs are the same. Two definitions are used in the calculations; the Adjusted Ring Length (ARL) and the Longest Lobe Length (LLL).

The ARL is the sum of cable lengths in the segments interconnecting the CMAUs, also called total ring length, minus the shortest cable segment. The reason the shortest segment is subtracted is that if the shortest segment fails, data will be transmitted the longest way using both the primary and the secondary ring.

The LLL is the longest lobe cable to any node in the ring.

The sum of ARL and LLL, A, can be up to:

- 500 m for a 4 Mbit/s Token-Ring network
- 200 m for a 16 Mbit/s Token-Ring network

These figures are independent of how many stations and wiring closets are interconnected.

CMAUs intended for RG 62 and RG 59 can be mixed in the same ring. When coaxial cables are used between the CMAUs, they can be either RG 62 or RG 59. This enables an installation with both RG 62 and RG 59 in the lobe cables to be mixed in the same ZAT 20 ring.

Example

How long can the Longest Lobe Length be in the figure below? The network runs at 16 Mbit/s.

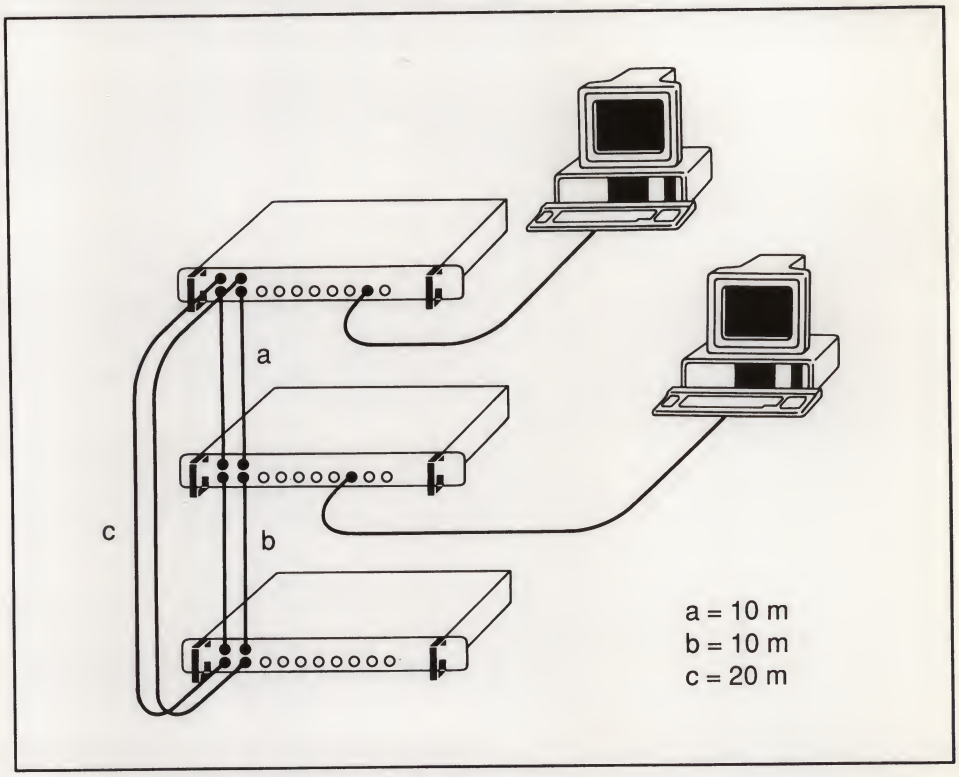

Figure 9. Configuration of ZAT 20 CMAUs.

Solution:

- ARL = 10 + 10 + 20 - 10 metres = 30 metres
- LLL = ?
- A = 200 metres (16 Mbit/s)

A = LLL + ARL ==>

200 = LLL + 30 ==>

LLL = 170 metres

Answer: The longest lobe length can be up to 170 metres.

The maximum station count in a Token-Ring network is 256. The station count for a station connected to a CMAU by means of coaxial cable is two. This means that up to 128 stations may be interconnected in an all ZAT 20 network.

Mixing Coaxial CMAUs with MAUs

The Coaxial CMAUs may be mixed with standard IBM type MAUs.

The interconnection is made with standard Type 1 to RG 62 baluns, i.e. "double red baluns". These red baluns can be used both with the CMAU for RG 62 and RG 59.

The distance calculation is made in the same way as in an all ZAT 20 network. The figure A can be:

- The least of 500 m or the IBM table for a 4 Mbit/s Token-Ring network.
- The least of 200 m or the IBM table for a 16 Mbit/s Token-Ring network.

For the IBM table please refer to the IBM documentation: GA27-3677-2 *Token-Ring Network Introduction and Planning Guide Appendix A*.

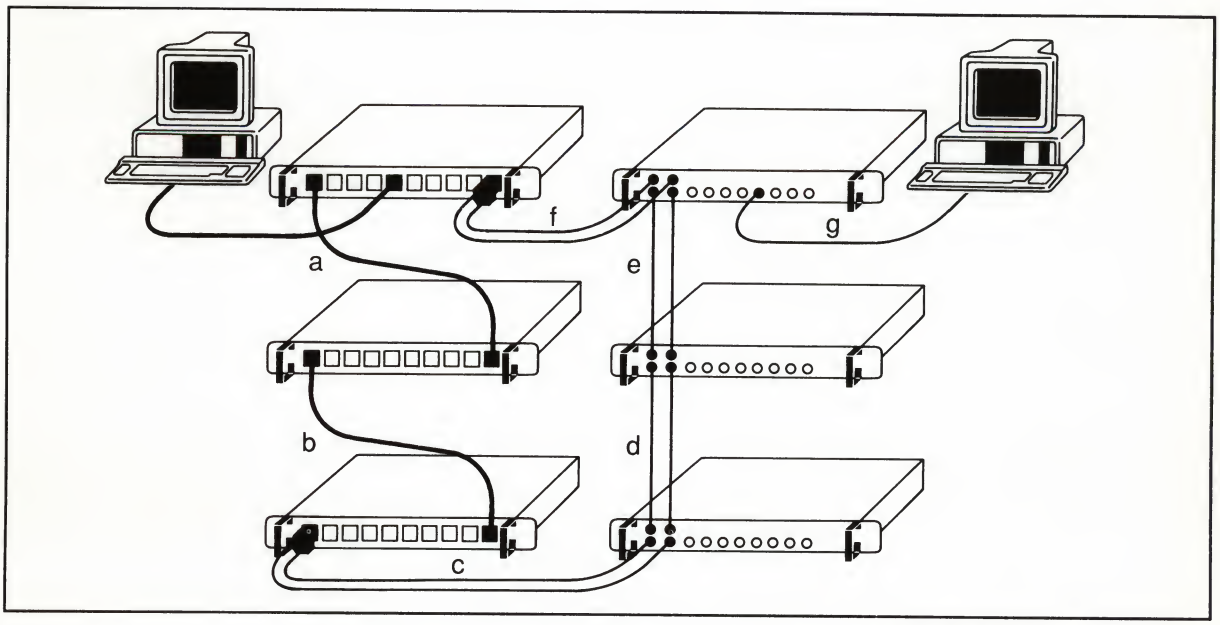

Figure 10. A network with Coaxial CMAUs and IBM-type MAUs mixed.

ARL = a + b + c + d + e + f - {the shortest length of a, b, c, d, e, f}
LLL = g , A = ARL + LLL

Mixing Type 1 CMAUs with MAUs

The Type 1 CMAUs may be mixed with standard IBM type MAUs.

The interconnection is always made with standard Type 1 patch cable. The distance calculation is made in the same way as in an all ZAT 20 network. The figure A can be:

- The least of 500 m or the IBM table for a 4 Mbit/s Token-Ring network.
- The least of 200 m or the IBM table for a 16 Mbit/s Token-Ring network.

For the IBM table please refer to the IBM documentation: GA27-3677-2 *Token-Ring Network Introduction and Planning Guide Appendix A*.

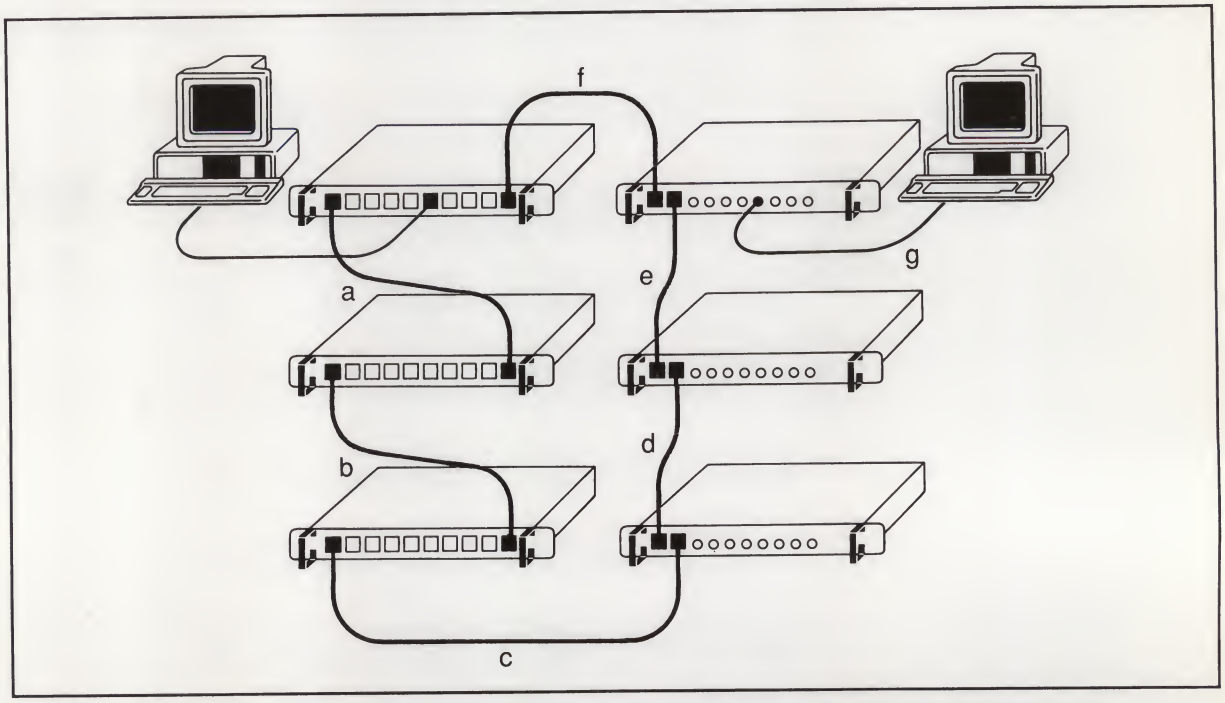

Figure 11. A network with Type 1 CMAUs and IBM-type MAUs mixed.

ARL = a + b + c + d + e + f - {the shortest length of a, b, c, d, e, f}
LLL = g , A = ARL + LLL

Installation

Introduction

Carefully lift the equipment out of its box. Make sure that all items have been delivered and that they are undamaged.

Save the original packing. It provides adequate protection for the equipment during storage and transportation. If other packing is used, remember to protect the equipment against vibrations and shocks. The ambient temperature during storage and transport must not be below -10°C or above +55°C.

When the CMAUs are connected to the mains power, it is important that the outlet is grounded and the connection is made with a grounded power cord. This is necessary for safety reasons.

CMAUs

The CMAUs are preferably installed in a 19" rack. The CMAUs can be stacked in the rack with spacing of at least 12 mm between every second CMAU, please refer to figure 13.

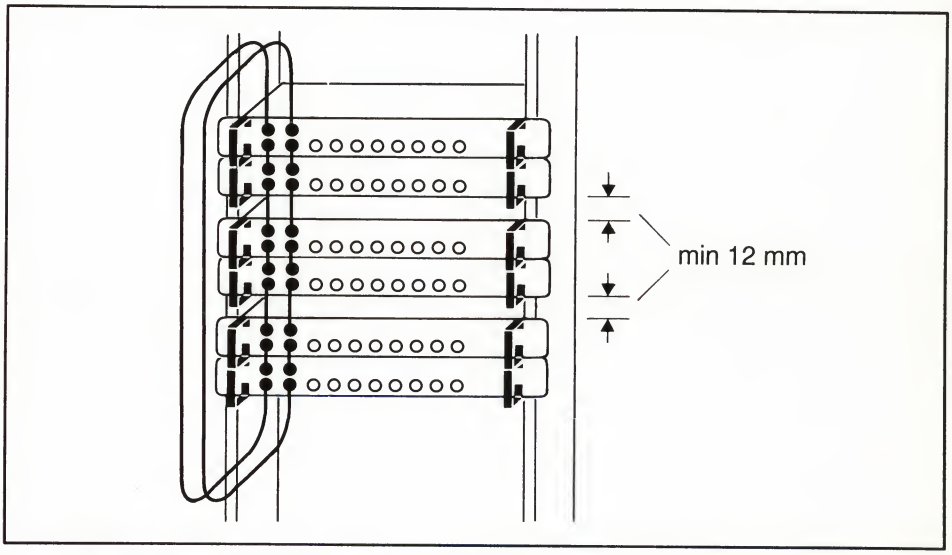

Figure 12. A 19" rack with ZAT 20 CMAUs.

When the CMAUs are mounted in the rack, connect them to the mains power via a grounded outlet. When a CMAU is powered, the green "power on" LED lights on the front panel.

Connect the CMAUs to each other via the trunk cabling. Ring In (RI) should be connected to Ring Out (RO). Figure 14 shows how two Coaxial CMAUs are interconnected. Connector RI 01 of the first CMAU is connected to RO 01 of the second CMAU, etc. If the connection is OK, the respective yellow LEDs should now be lit. When Type 1 CMAUs with cable protection are installed, the RI/RO LEDs light only if the connections are OK and if a station is active on respective CMAU. The signal is otherwise passed through.

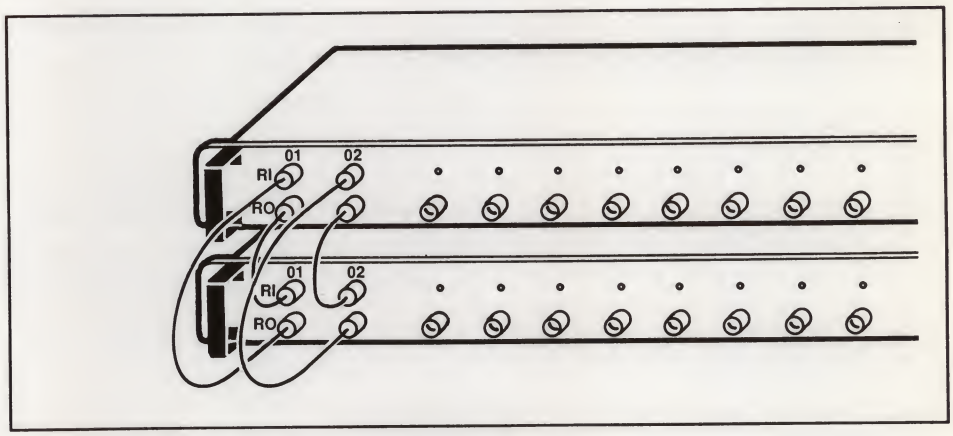

Figure 13. Two Coaxial CMAUs interconnected.

Proceed with the other CMAUs until all units are interconnected. All RI/RO LEDs should now light.

CTCs

The Coaxial Token-Ring Connectors (CTCs) are directly attached to the DB9 connector of a standard electrical Token-Ring board in the station, please refer to figure 15.

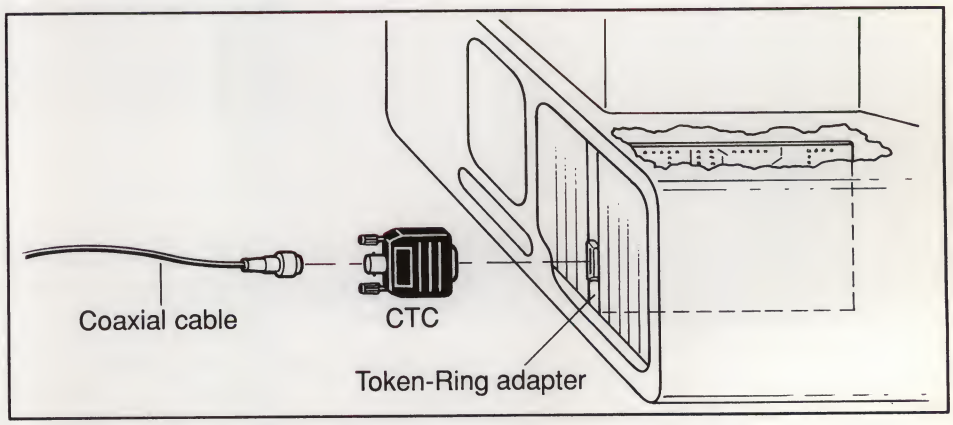

Figure 14. The CTC is attached directly to the Token-Ring board.

In order to get good electrical contact, it is important that the CTC is firmly attached to the Token-Ring board.

When the coaxial cable is connected both to the CTC and the CMAU lobe port, run the diagnostic software for the Token-Ring board in order to check connection to the CMAU. When the station is active on the ring, the yellow lobe LED on the CMAU front panel will light.

Coaxial CMAUs and MAUs

The connection between a Coaxial CMAU and an IBM-type MAU is made with two coaxial cables and a "double red balun".

A red balun is inserted in the RI and RO of the MAU and connected to RO and RI of the Coaxial CMAU with coaxial cables, please refer to figure 16.

The connections are as follows:

CMAU	MAU
RI 01	RO red balun port 1
RI 02	RO red balun port 2
RO 01	RI red balun port 1
RO 02	RI red balun port 2

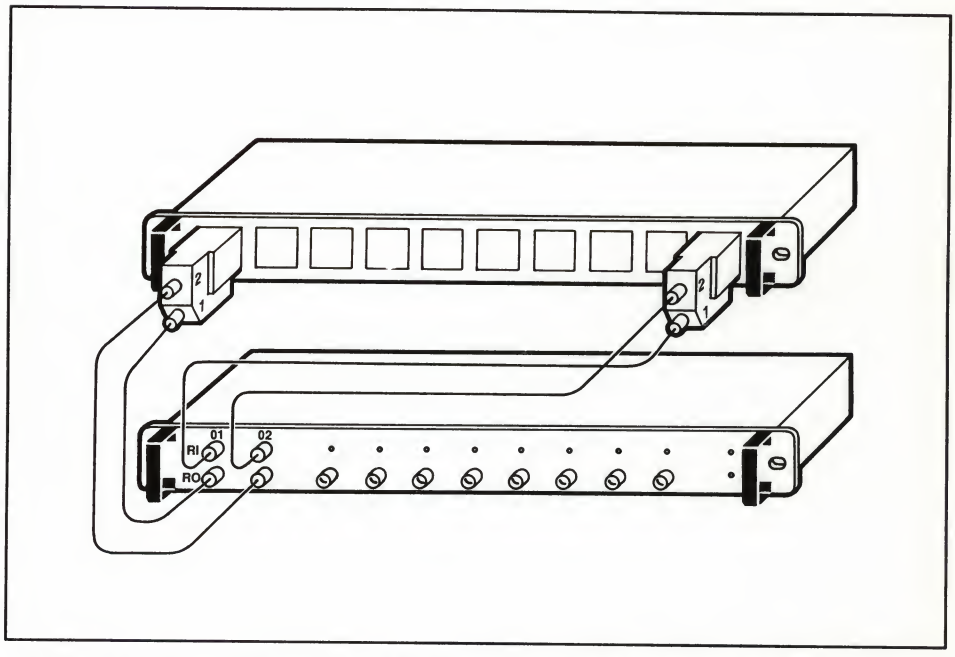

Figure 15. Coaxial CMAUs and MAUs are connected with red baluns.

Type 1 CMAUs and Token-Ring repeaters

When Type 1 CMAUs without cable protection and IBM type Token-Ring repeaters are mixed, standard Type 1 patch cables are used.

When a Type 1 CMAU with cable protection and a IBM type Token-Ring repeater are interconnected in the same ring, a Red loop-back cable must be used. The reason for this is that the cable protection in the trunk segment is an enhancement of the Token-Ring standard. The Red loop-back cable can be installed anywhere between the repeater and the first CMAU. It is used to feed the sensing of the trunk segment back to the CMAU.

Troubleshooting

In case of malfunction, verify, if possible, whether the trouble is caused by an external source or within the system. External factors that may influence the system are:

- Power failure
- Cable damage
- Internal software or hardware fault within a station

If the malfunction is not caused by an external factor, then follow the troubleshooting chart on the next page to locate the faulty unit.

If you cannot locate the cause of the trouble, or cannot rectify it on your own, contact service personnel.

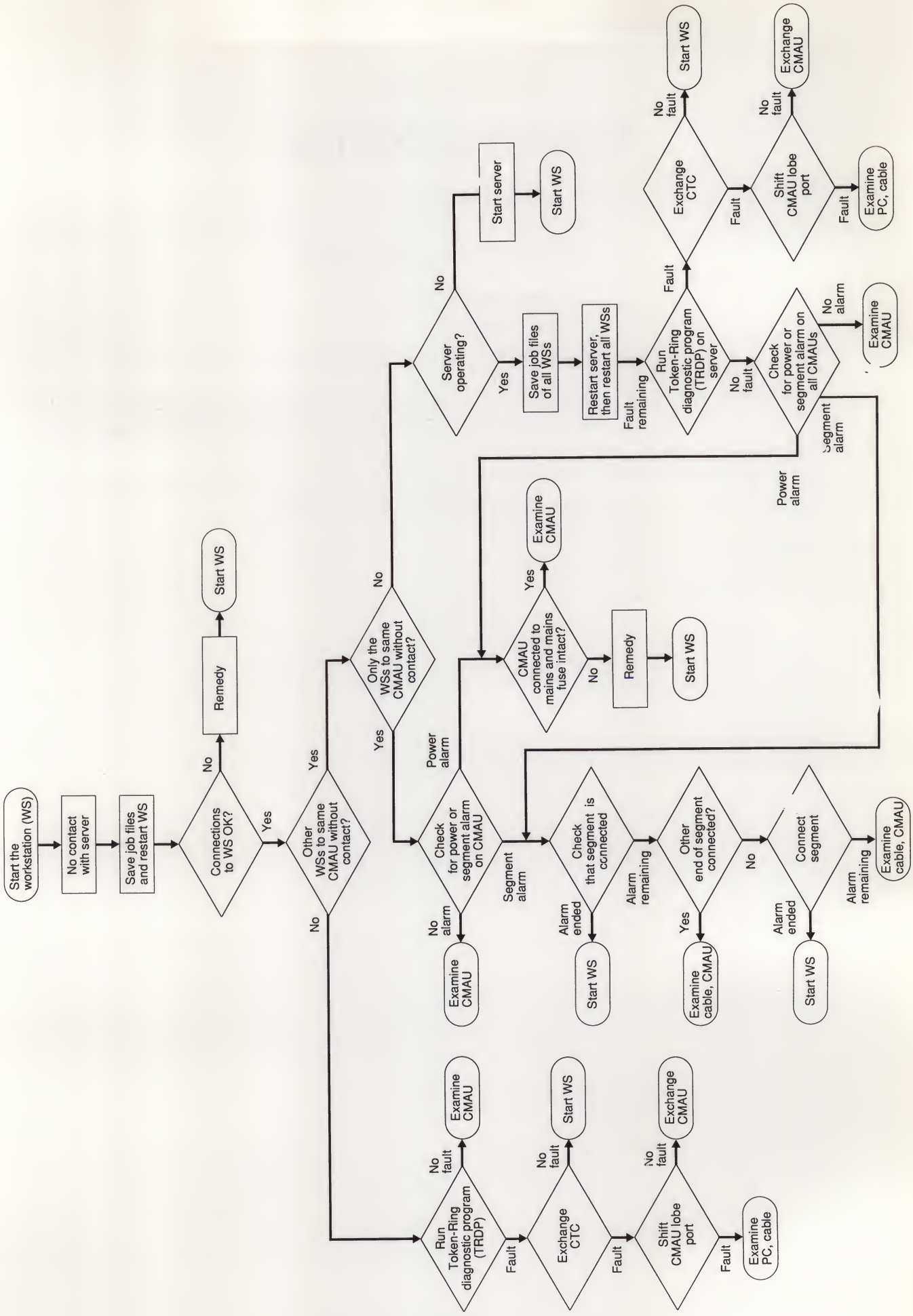

Figure 16. Troubleshooting chart.

Modifying and extending the system

With the ZAT 20 system, it is possible to modify and extend a running ZAT 20 network due to the loop-back feature of the CMAUs. It is recommended to check the function of new CMAUs before they are added to a running network. This is to prevent accidental disruptions of the network.

It is also important to check that no segment in the running network is looped before new CMAUs are made active. If one segment in the running system is looped, then the network will be divided into two separate rings until the new CMAU has been connected.

Accessories

Product name	Ordering number
Coaxial CMAU 93 ohm/CP	KDU 203 09
Coaxial CMAU 75 ohm/CP	KDU 203 10
Type 1 CMAU 93 ohm/CP	KDU 203 11
Type 1 CMAU 75 ohm/CP	KDU 203 12
Type 1 CMAU 93 ohm	KDU 203 81
Type 1 CMAU 75 ohm	KDU 203 82
CTC 93 ohm	KDU 203 13
CTC 75 ohm	KDU 203 14
Red loop-back cable	KDU 203 83

Applications

Introduction

Today, most of the 3270 terminals are connected to control units via coaxial cables. When a user needs to replace his 3270 terminal with a PC or PS/2 connected to a Token-Ring Local Area Network, he has so far been forced to install new twisted pair cabling, either shielded or unshielded. With the ZAT 20, he can instead in a simple and easy way use the already installed coaxial cables. This way the user is not affected by a time consuming and costly recabling of the building to be able to use the advantages of a Token-Ring network.

For companies with coaxial cabling and the need for a Token-Ring network, the ZAT 20 system is the solution. This enables a company to postpone a recabling until they need fibre optic cabling to the desk.

Example 1

A department in a large company would like to make use of personal computers instead of 3270 terminals to be able to share local files and special printers. Until now the whole building would have to be re-cabled, because one can never tell to which room people with PC requirements would move. With the ZAT 20, it is only necessary to replace the 3270 terminals with PCs. Via the CTCs, the PCs will be connected to the existing coaxial cables. The coaxial cables are disconnected from the cluster controller and connected to the CMAU and the Token-Ring network can be started.

Example 2

A company has established a twisted pair Token-Ring network in a dedicated room for test purposes. At this point, they would like to go into production by connecting other people to the Token-Ring network. The problem is that the building is cabled with coaxial cables. With the ZAT 20 it is very easy to solve the problem. The new PCs are connected to one or more CMAUs in the same way as in the example above. All that is required is to connect one of the CMAUs to a standard IBM-type MAU by means of a balun. This can be done PC by PC without disturbing the user communication on the LAN.

Examples

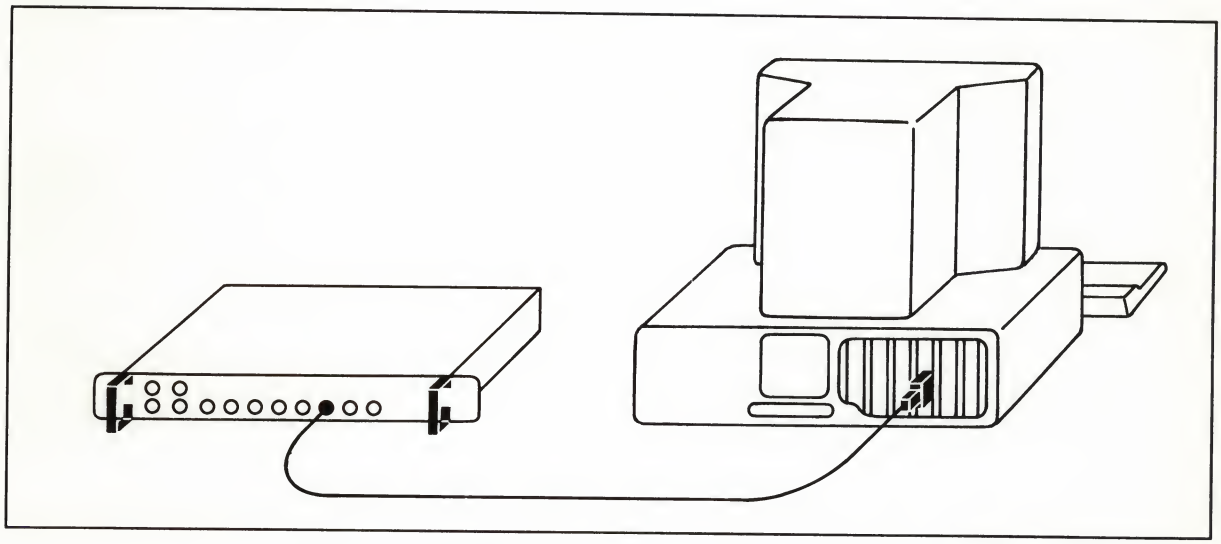

Figure 17. A CTC is directly connected to a standard electrical Token-Ring board.

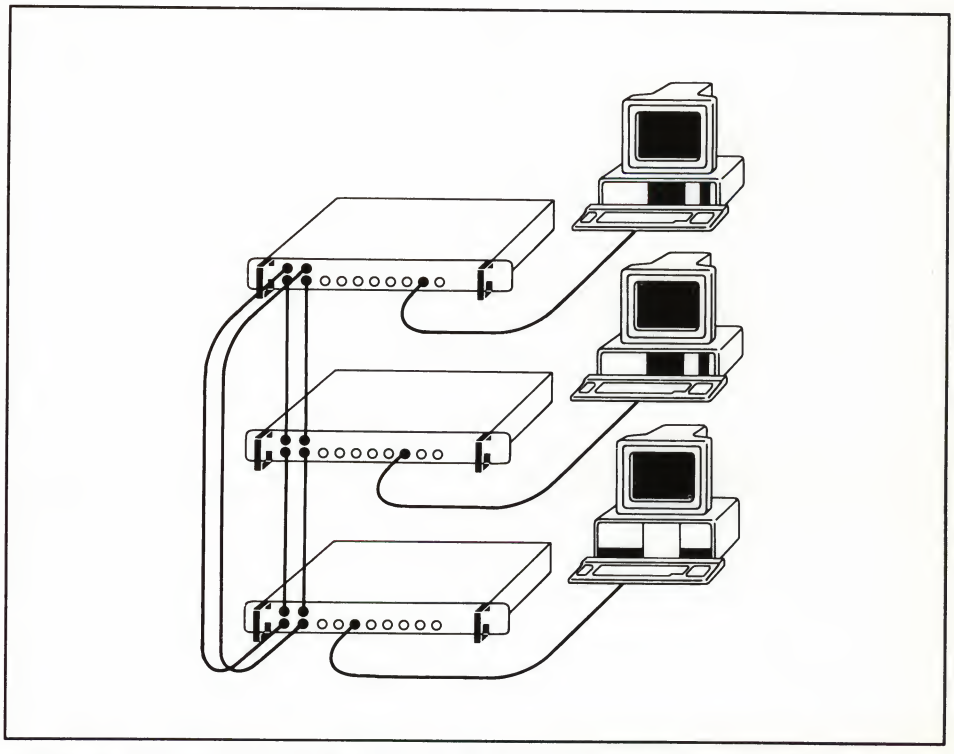

Figure 18. Several Coaxial CMAUs may be interconnected by means of dual, redundant coaxial cabling.

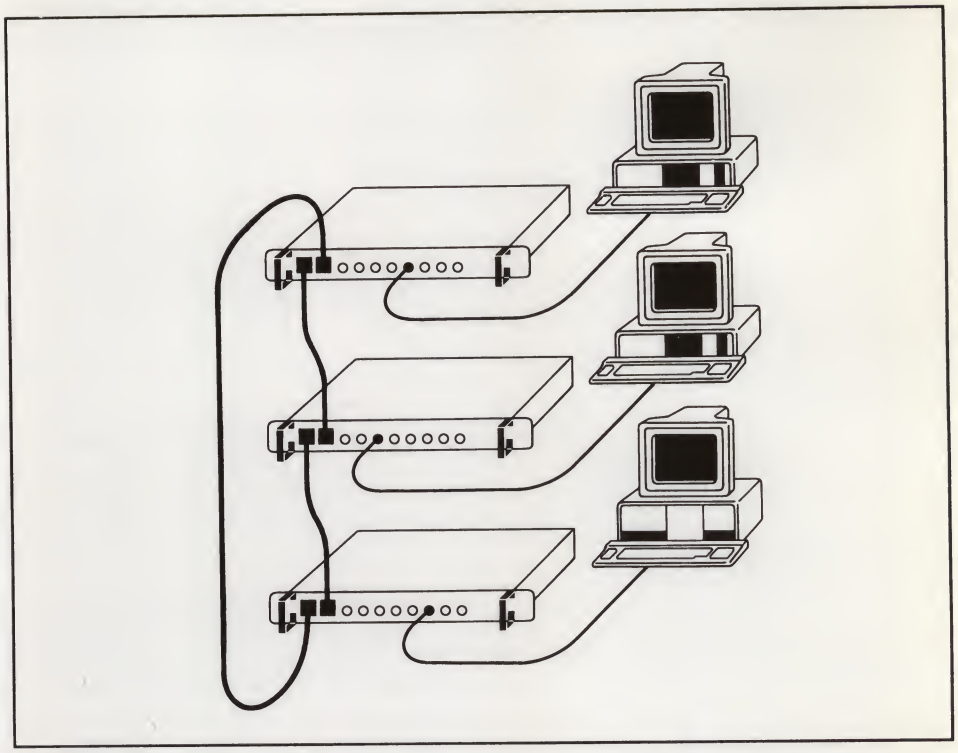

Figure 19. Several Type 1 CMAUs may be interconnected by means of standard Type 1 cabling.

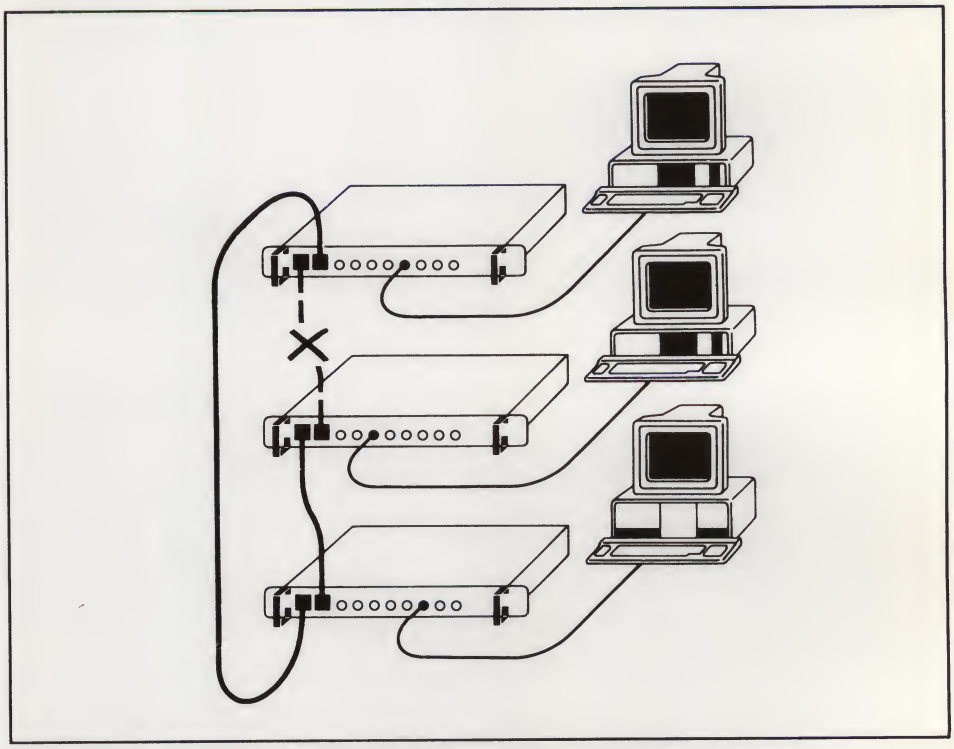

Figure 20. Type 1 and Coaxial CMAUs can automatically reconfigure in case of cable segment failure. No station loses its access to the ring.

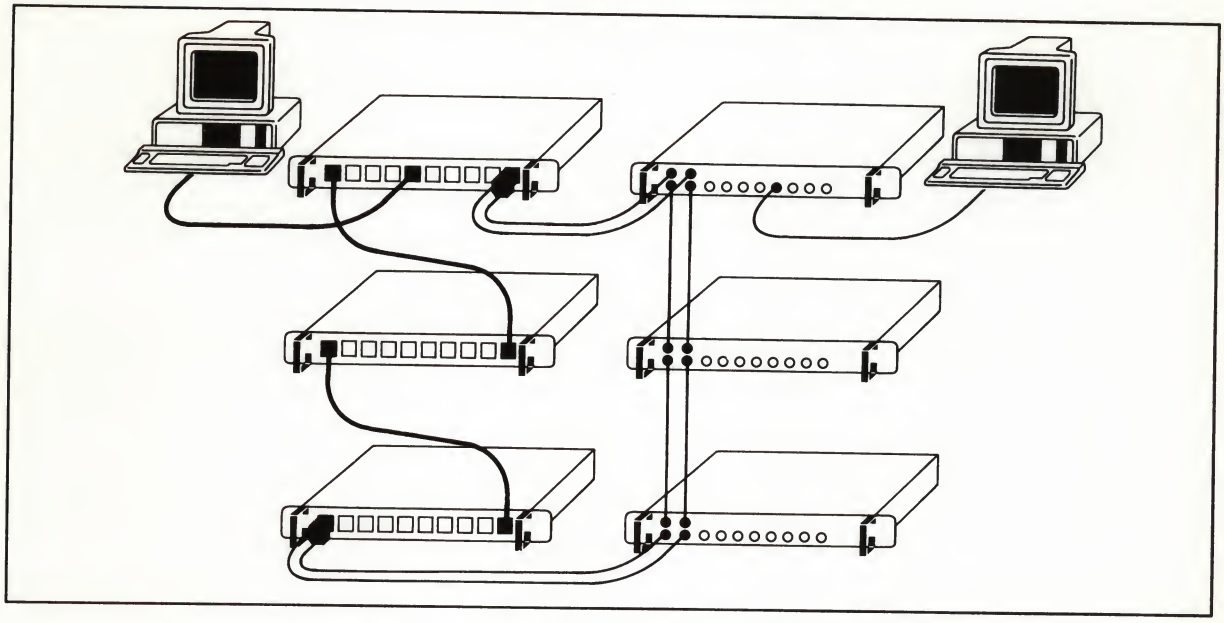

Figure 21. A network with Coaxial CMAUs and IBM-type MAUs mixed.

A World First

ZAT 20

Coaxial Token – Ring

Keep cool – keep your coax!

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